Objectives:

After this workshop participants should be able to:
1. Understand the basics of normal and difficult pediatric airway anatomy
2. Learn about different supraglottic devices.
3. Learn and practice fiberoptic intubation and trouble shoot common problems faced during performing fiberoptic intubation in children.
4. Learn and practice other intubating methods like Bullard scope, lighted stylets and retrograde intubation techniques.

Normal Pediatric Airway:

It is important to learn differences between pediatric and adult airway which have significant impact on the airway management in smaller children. At birth, the neonatal larynx is positioned at the level of C3-4 cervical vertebra. This cephalic position of laryngeal inlet along with large omega shaped epiglottis and posteriorly paced tongue form a ‘glossopharyngeal sphincter’. Newborns and smaller infants are called ‘obligatory nasal breathers’ because this dynamic glossopharyngeal sphincter allows them to feed and breath simultaneously. A large occiput and cephalic position of the laryngeal inlet results in an anteriorly positioned larynx. Another anatomical feature of neonatal larynx is the prominent arytenoid cartilages and deeply seated vocal cords. Vocal cords in a neonate and smaller children are angled anteriorly. These subtle differences are particularly important to remember while performing fiberoptic laryngoscopy.

Difficult Pediatric Airway:

Fortunately the incidence of the unexpected difficult pediatric airway is low. Most of the airway abnormalities are associated with congenital syndromes. Detailed preoperative examination of airway can be difficult in an uncooperative patient. Even significant hypoglossia can be easily missed on casual examination of face from frontal view. One must, therefore, evaluate all children in profile. For the sake of practicality- all difficult airways can be divided into three main groups:

a) Access Problems: This group includes children with limited access to the airway. A large tongue in Beckwith- Wiedeman Syndrome, Hunter’s or Hurler’s Syndrome or limited mouth opening as seen in Freeman- Sheldon syndrome can pose significant challenge in accessing the airway.

b) Visualization Problems: Direct laryngoscopy requires displacement of tongue in the retro-mandibular space. In patients with severe hypoglossia e.g. Pierre — Robin, Treacher Collin syndrome, tongue cannot be displaced and results in poor
visualization of laryngeal inlet. Other examples include children with limited cervical mobility, presence of laryngeal cysts etc.
c) Target Issues: Children with anatomical anomalies with larynx and trachea e.g. subglottic stenosis, mediastinal mass, laryngeal webs etc. Anesthesiologists needs to especially cautious in their approach to this group. One can usually visualize laryngeal inlet easily in these children but passage of endotracheal tube may still be impossible.

**Airway Management:**

No airway equipment can replace a thorough preoperative evaluation and detailed set up of the operating room. One must have a backup plan and clear decision tree. The choice of device depends on the comfort and experience of the anesthesiologist. All of the airway devices can be grouped into two main categories:

1. Alternatives to entotracheal intubation
2. Alternatives to direct laryngoscopy

1. **Alternatives to Endotracheal Intubation: Supraglottic devices**

Supraglottic devices can be used to secure airway for short period of time. These devices can be easily inserted blindly and can be used for positive pressure ventilation. These devices do not provide adequate protection against pulmonary aspiration. A large number of such devices are available in the market. LMA is probably one of the most used and tested devices. Both LMA and CobraPLA are available in sizes suitable for neonates as well as smaller children.

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In smaller children and neonate, positioning of LMA can be less than ideal. Park et al in a prospective study concluded that use of the LMA in smaller children results in frequent airway obstruction, higher ventilatory pressures, larger inspiratory leak, and more complications than in older children. In smaller LMAs, the cuff frequently encloses the epiglottis. Therefore it is recommended that in smaller children a fiberoptic laryngoscope should always assist endotracheal intubation through LMA.
Alternatives to direct laryngoscopy:

1. Lighted Stylets
   A number of devices use lighted stylets to guide the passage of endotracheal tube. These stylets are helpful in patients with restricted cervical movement and oral bleeding. These lighted stylets are loaded with endotracheal tube and shaped into a ‘hockey stick’ configuration. The room lights are dimmed and the stylet is introduced orally or nasally and an attempt is made to keep the stylet in the midline. A bright light at the level of hyoid is noticed and stylet is advanced gently. A ‘cherry red midline glow moving caudal indicates tracheal intubation. A brief loss of light followed by dimmer midline glow probably indicates esophageal intubation. A pre-operative diagnosis of subglottic stenosis is a relative contraindication for this technique. A newer modification of lighted stylets is the ‘Seeing Stylet’. Also known as a Shikani stylet, it is a fiberoptic endoscope made from malleable stainless steel. It has a pre-formed “J” shape that may be molded to a limited degree for the individual patient. It has a high resolution (30 000 pixel) image bundle with separate glass illumination fibers, and an eyepiece attachment that does not have a focus adjustment. A sharp image is obtained without the need to focus and, as with conventional bronchoscopes, the eyepiece can be connected to a video camera.

2. Bullard scope:
   Bullard scope is a good marriage between a direct laryngoscope and a fiberoptic scope. It is available in both pediatric as well as adult sizes. It is helpful in patients with restricted mouth opening and where cervical movement is to be minimized.

3. Fiberoptic Intubation:
   Fiberoptic intubation remains the mainstay for difficult airway management. It allows visualization of airway anatomy and intubation under direct vision. It is also less traumatic than other techniques. One must however, become proficient in fiberoptic intubation by gaining experience on children with normal anatomy. Its use is also limited in the presence of oral bleeding. Pediatric airway anatomy should be kept in mind while performing fiberoptic intubation. For oral intubation it is always better to position the scope in the midline. Because of the anterior and cephalic position of larynx, the fiberoptic scope has to make an acute anterior angulation. The nasal approach allows a better approach towards glottis, however, any trauma to adenoid tissue can cause substantial bleeding. Once the glottis is visualized attempts should be made to approach the anterior commissure. A quick posterior deflection at this point will guide the scope towards the trachea. After identifying the carina, attempting to pass endotracheal tube is often met with resistance. Keeping the fiberscope taut and turning the endotracheal tube 90 degree often facilitates easy passage of endotracheal tube. Minimizing any discrepancy between diameter of the tube and the size of scope can avoid trapment of arytenoids cartilages in the endotracheal tube. Use of armor tubes also facilitates intubation.

Bibliography:


